Title: Shape Your Life: Personal Polygon Timeline

Link to Outcomes:

- **Problem Solving** Students will use protractors to create polygons.
- **Communication** Students will communicate reasons for structure, size, and shape of polygons to classmates.
- **Connections** Students will connect the topic of polygons and use of angles to the social studies topic of timelines.
- **Reasoning** Students will reason geometrically. They will form regular and irregular polygons without exceeding total sum boundaries for each polygon.
- **Habits of Mind** Students will make decisions about polygons using data they collected.
- **Cooperative Learning** Students will analyze other students' polygons and their reasoning.
- **Estimation & Computation** Students will demonstrate their ability to apply estimation strategies in computation, with the use of technology, in measurement of angles, and in problem solving.
- **Technology** Students will demonstrate their ability to solve problems using arithmetic operations with technology where appropriate.
- **Geometry & Spatial Sense** Students will demonstrate their ability to describe and apply geometric relationships using one, two, and three-dimensional objects.
- **Measurement** Students will demonstrate and apply concepts of measuring angles. They will estimate and verify angle sum totals of polygons. They will apply measurement to interdisciplinary and problem-solving situations.
- **Statistics** Students will demonstrate their ability to collect, organize, and display data and will interpret obtained information.
- **Patterns & Relationships** Students will demonstrate their ability to recognize numeric and geometric relationships and will generalize a relationship from data.
- **Mathematical Disposition** Students will demonstrate a positive attitude toward mathematics in school and will value and appreciate the role of mathematics in school, culture, and society.

Brief Overview:

This activity integrates geometry with the study of timelines and should be used as a culmination to a geometry unit on polygons. This activity can be completed by using historical or personal events. Students will research and list important events in their lives. They will then assign events with angle degree measurements in order of importance to allow accurate shapes without exceeding angle sum totals. For each year in their lives, they will then be able to construct a polygon.

Grade/Level:

Grade 5/6

Duration/Length:

This activity should take approximately five - 45 minute class periods. However, extra time can be allotted based on students' proficiency with protractors.

Prerequisite Knowledge:

- Students should have basic knowledge of timelines.
- Students should have basic knowledge of polygons.
- Students should be able to use protractors to measure angles.
- Students should understand concepts of angles (acute, right, and obtuse) and degrees.
- Students should understand that the degree measurement of a line is 180 degrees.

Objectives:

- Define, illustrate, and utilize a timeline.
- Determine patterns of sum totals of degrees of interior angles of polygons.
- Research and describe critical developmental experiences.
- Apply geometric properties to construct a timeline.
- Develop an event/degree conversion list.
- Analyze and discuss results in cooperative groups.

Materials/Resources/Printed Materials:

- Protractor
- Chart paper
- Markers
- Student Resource Sheets Numbers 1-9

Teacher's Materials

- Transparency Sheets (for Triangle Wheel and copies of Student and Teacher's Resource Sheets)
- Teacher's Resource Sheets Numbers 1-6
- Pattern Blocks

Development/Procedures:

Day 1 - Students will review timelines and polygons.

- Review with students concepts learned about timelines in social studies. Use current social studies text as a guide.
- Assign to the students personal research using Interview Forms (Student Resource Numbers 1 and 2). Sample Answers can be found on Teacher Resource Numbers 1 and 2.
- Review polygons with the students using Student Resource Sheets Numbers 3 and 4 in order to visualize and verbalize shapes.
- Review categories of two-dimensional shapes using Student Resource Sheet Number 5 and sample polygons. Students will form cooperative groups with each group receiving a pattern block. The group will list characteristics of the shape according to Student Resource Sheet Number 5, and they will share its results with the class.

Day 2 - Students will review measuring angles and calculating angle sum totals.

- Review use of protractors to measure angles.
- Review total sum degrees of triangles and quadrilaterals using Student Resource Sheets Numbers 6, 7, and 8. Answers are in Teacher Resource #3.

Day 3 - Students will explore interior angle measurements of polygons using logo software, the computer, and Triangle Wheels.

- Students will use the triangle wheel (Teacher Resource Sheet Number 4) and explore Interior and Exterior Turtle Angles (Student Resource Sheets Numbers 9 and 10) in cooperative groups. Answers to Student Resource 9 and 10 are located in Teacher Resources 5 and 6.
- (Option) If logo software is not accessible, Student Resource Sheets Numbers 11 and 12 may be used to analyze interior angle sum totals of polygons. Answers to these resources are found in Teacher Resource #3.

Day 4 - Students will use information from Interview Forms (Student Resource Sheet Numbers 1 and 2) to create a polygon timeline.

Students will

- review personal critical events for each year.
- consider each critical event as a vertex.
- determine degree of angles at each vertex according to importance of events, paying close attention to the total angle sum for each polygon.
- form a polygon for each year using the vertices assigned for each event.
- chart results on Student Resource #2.
- create an event/degree conversion list and place on each chart as a key (See Teacher Resource Sheet Number 9).

Day 5 - Students will share polygon timelines.

- Students will form cooperative groups.
- Groups will list similarities and differences of polygons for each year.
- Each group member will write a clear explanation of one shape on another member's timeline according to importance of events.
- Students will discuss differences in degrees of angles based on importance of events.

Evaluation:

Students will be assessed based on the following criteria:

- utilization of timeline.
- ability to create a variety of polygons.
- ability to record and identify created shapes.
- ability to collect required data using Interview Form.
- accuracy in writing a clear explanation of each shape according to importance of events.
- group participation and performance.

Extension/Follow Up:

A geometry extension could be to find lines of symmetry for each polygon on the timeline. A second extension could be to find congruency and corresponding parts.

A social studies extension could be to create a polygon timeline for the life of a famous person. For example, students may use Rosa Parks during Black History Month. A second extension could be to have the class create a polygon timeline for a unit in history.

Authors:

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NAME_____DATE_____

STUDENT INTERVIEW FORM

DIRECTIONS: Use the categories below to identify critical events that occurred in your life at different age levels. Add other critical events which you consider important that may have occurred in your life. Gather information from family members or friends to assist in completing the **Student Interview Form - Events Sheet**. List your sources at the end of the sheet. You must select at least three but no more than 8 events. Fill in your events in the corresponding age blocks. The source and totals portions will be completed in class.

SUGGESTED CRITICAL EVENTS:

Began Talking
Began Crawling
Began Walking
First Words
Birthday Party
Birth of Sibling
Began School
Vacation
Summer Event with Close Relatives
Summer Event with Friends
Airplane Ride
Train Ride
Boat Ride
Bus Ride
Honor Roll
Student Government
Dramatics
Sports
Music Lessons
Team Sports
Visited Another City, State, or Country
Pajama Party
Ballet Participant
Skiing
Tennis
Basketball
Football

NAME _____ ***DATE*** _____

STUDENT INTERVIEW FORM - EVENTS SHEET

YEARS	EVENTS / DEGREES								TOTALS
0 - 1									
1 - 2									
2 - 3									
3 - 4									
4 - 5									
5 - 6									
6 - 7									
7 - 8									
8 - 9									
9 - 10									
10 - 11									

SOURCES: _____

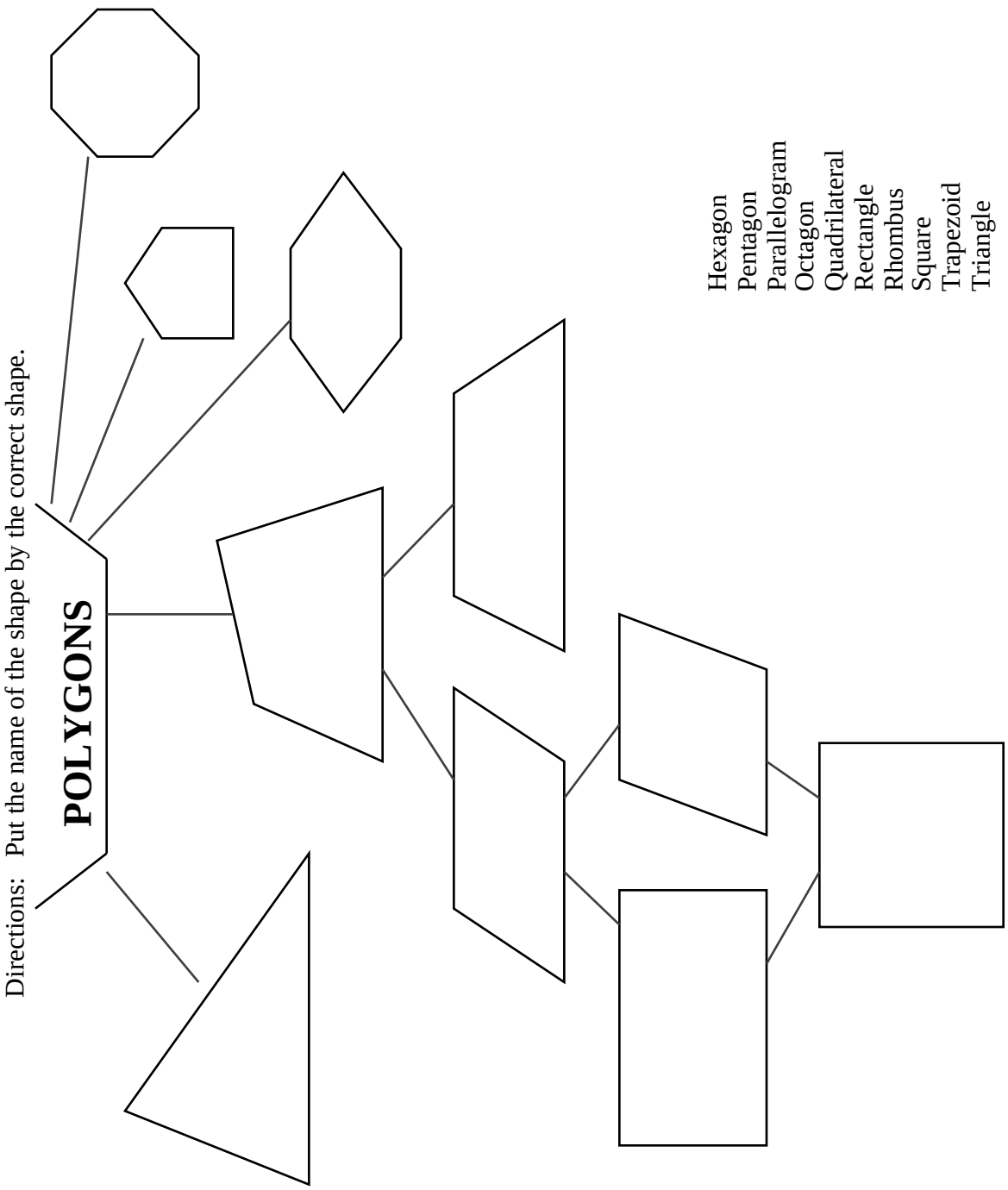
_____

_____

POLYGON SHAPE TREE

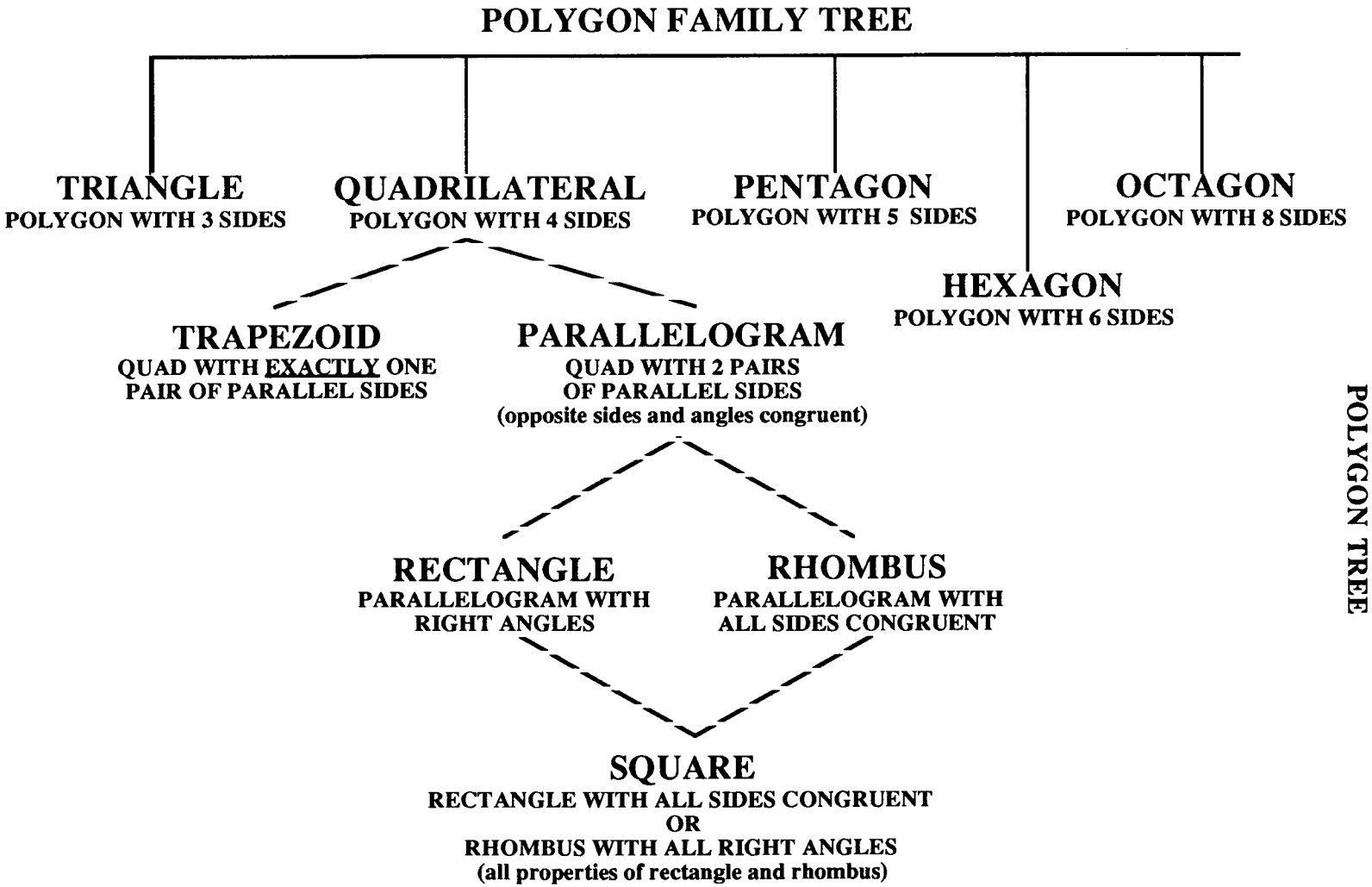
Name_____ Date_____

Directions: Put the name of the shape by the correct shape.



Hexagon
Pentagon
Parallelogram
Octagon
Quadrilateral
Rectangle
Rhombus
Square
Trapezoid
Triangle

POLYGON FAMILY TREE



EACH FIGURE HAS ALL THE PROPERTIES OF THE ABOVE FIGURES FROM WHICH IT DESCENDS.

Different Categories of Two-Dimensional Shapes

Polygons

regular
nonregular

Triangles (classified by sides or by angles)

sides - equilateral, isosceles, scalene
angles - right, acute, obtuse

Quadrilaterals

names depend on number of sides

Trapezoids

isosceles or not isosceles

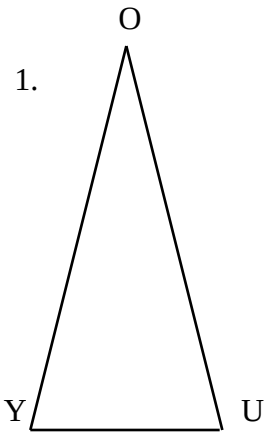
Parallelograms (classified by sides or by angles)

sides - all sides congruent = rhombus
angles - right angle = rectangle

Student Resource #6

Use your protractor to measure each angle, record each answer below, and find the sum of the angles. Look for a pattern in the sums.

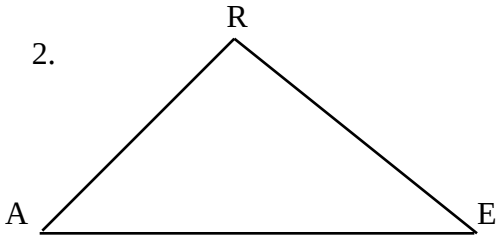
1.



Measure Y = _____
Measure O = _____
Measure U = _____

Sum of the angles =

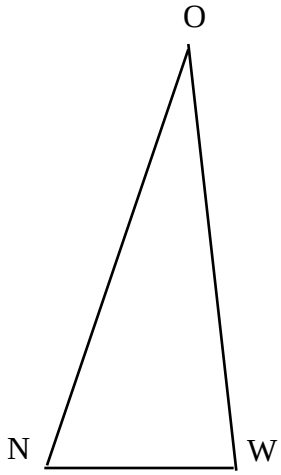
2.



Measure A = _____
Measure R = _____
Measure E = _____

Sum of the angles =

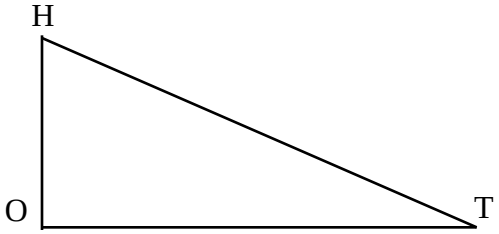
3.



Measure N = _____
Measure O = _____
Measure W = _____

Sum of the angles =

4.



Measure H = _____
Measure O = _____
Measure T = _____

Sum of the angles =

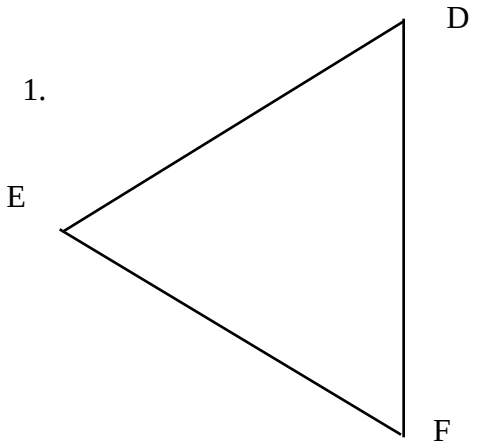
5. What pattern do you notice? _____

Do you think this pattern will hold for all triangles? _____

Student Resource #7

Use your protractor to measure each angle, record each answer below, and find the sum of the angles. Does your pattern hold for these triangles?

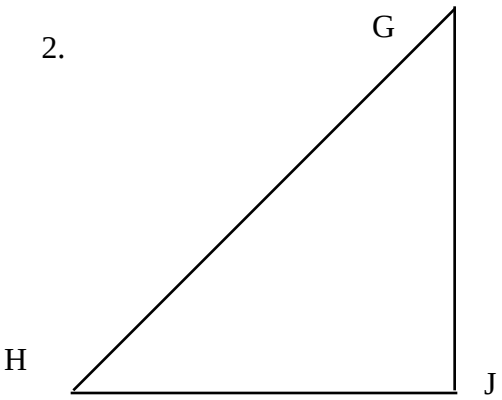
1.



Measure E = _____
Measure D = _____
Measure F = _____

Sum of the angles =

2.



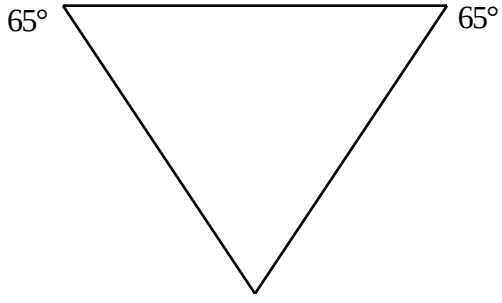
Measure G = _____
Measure H = _____
Measure J = _____

Sum of the angles =

Challenge

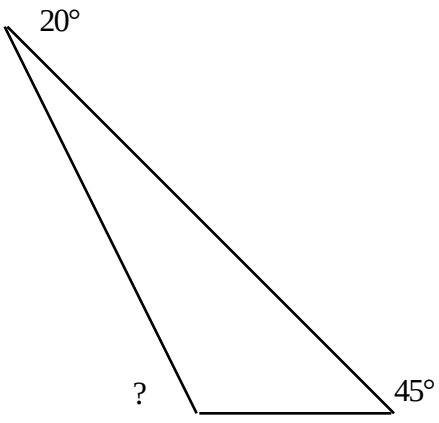
Use the pattern you discovered to help find the measure of each angle labeled with a question mark. Check your answers using your protractor.

3.



? _____

4.



? _____

Student Resource #8

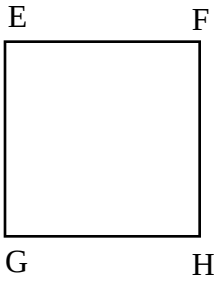
Use your protractor to measure each angle, record each answer below, and find the sum of the angles. Look for a pattern in the sums.

1.

Measure A= _____
Measure B = _____
Measure C = _____
Measure D = _____

Sum of the angles = _____

2.

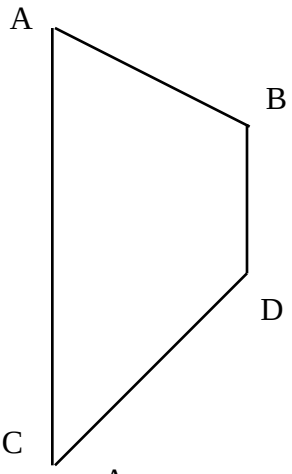


J

Measure E = _____
Measure F = _____
Measure G = _____
Measure H = _____

Sum of the angles = _____

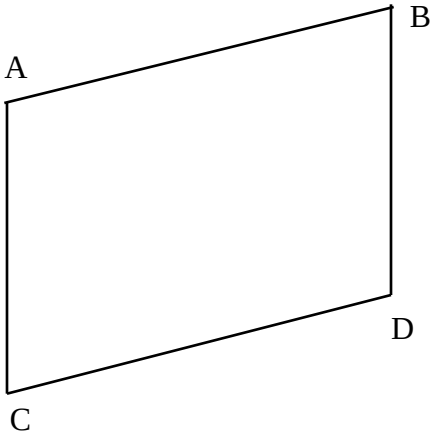
3.



Measure A= _____
Measure B = _____
Measure C = _____
Measure D = _____

Sum of the angles = _____

4.



Measure A= _____
Measure B = _____
Measure C = _____
Measure D = _____

Sum of the angles = _____

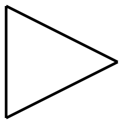
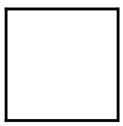
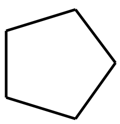
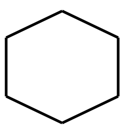
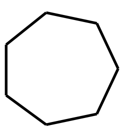
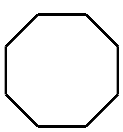
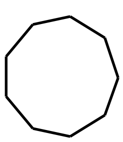
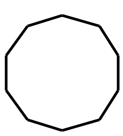
5. What pattern do you notice? _____

Do you think the pattern will hold for all quadrilaterals? _____

Exploring Interior and Exterior Turtle Angles

Name ______________________________ **Date** _______________________

Directions: Explore with the REPEAT command to construct each of the regular polygons below. Examine the shape to determine how many times the turtle repeats the pattern. Use the computer and logo software to determine the number of degrees in each turn. The first command for each program should be **fd 80 bk 80** to draw a line that will help measure angles.

SHAPE	COMMAND
	**REPEAT _____ [FD 40 RT ____]** **Name of shape** ___________________________
	**REPEAT _____ [FD 40 RT ____]** **Name of shape** ___________________________
	**REPEAT _____ [FD 40 RT ____]** **Name of shape** ___________________________
	**REPEAT _____ [FD 40 RT ____]** **Name of shape** ___________________________
	**REPEAT _____ [FD 40 RT ____]** **Name of shape** ___________________________
	**REPEAT _____ [FD 40 RT ____]** **Name of shape** ___________________________
	**REPEAT _____ [FD 40 RT ____]** **Name of shape** ___________________________
	**REPEAT _____ [FD 40 RT ____]** **Name of shape** ___________________________

Adapted from Logo Geometry - Grade Three Curriculum Guide, Howard County Public School System, 1992.

Exploring Interior and Exterior Turtle Angles

Name_____ **Date**_____

1. Subtract your turn command angle from 180. Multiply your answer by the number of angles in the polygon.

2. Fill in the chart below.

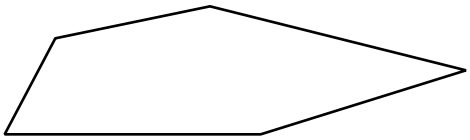
Shape	Number of Sides	Total Angle Sum
Triangle		
Square		
Pentagon		
Hexagon		
Octagon		

3. What pattern do you see when comparing the total angle sums?

4. Would the total angle sum change if the figure is irregular? Why or why not?

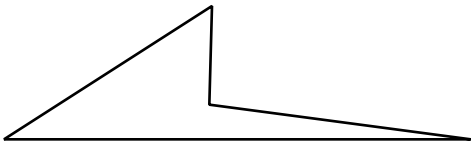
Student Resource #11

1. Use your protractor to measure each angle of the following polygons. Find the sum of the angles for each one.



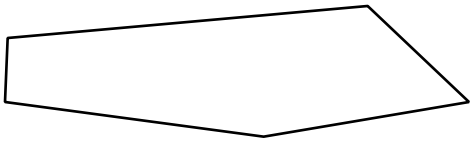
A. Sum of the angles = _____

B. Sum of the angles = _____



C. Sum of the angles = _____

D. Sum of the angles = _____



E. Sum of the angles = _____

F. Sum of the angles = _____

Record the angle sums from the previous page in the chart below according to the number of sides of each polygon.

How many sides?	What is the Sum of the Angles?
3	180°
4	
5	
6	
7	
8	
N	

What patterns do you notice?

NAME *Jane Doe* **DATE** *9/9/99*

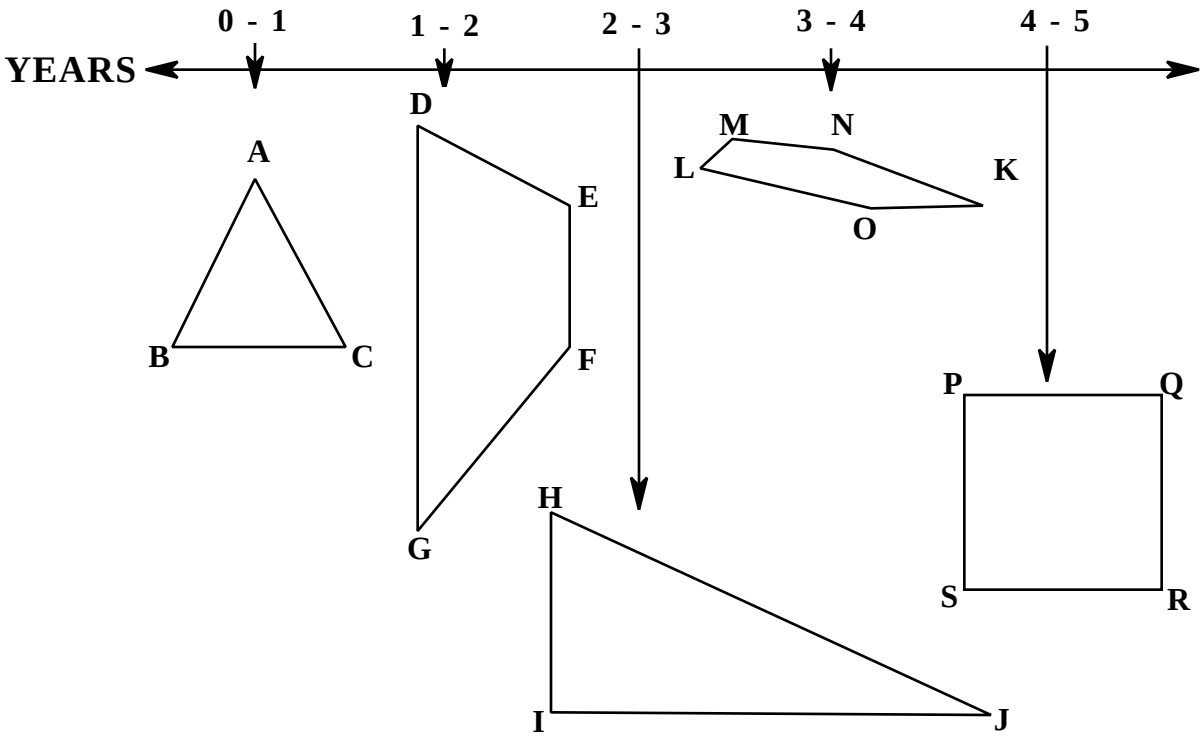
STUDENT INTERVIEW FORM - EVENTS SHEET

YEARS	EVENTS / DEGREES								TOTALS
0 - 1	teeth 60°	first words 60°	first step 60°						
1 - 2	train ride 65°	TV ad star 110°	first party 50°	movie star 135°					
2 - 3	pre school 65°	new sis 90°	pot 25°						
3 - 4	ballet 15°	beach 55°	ski 130°	see grand ma 175°	first book 165°				
4 - 5	Kdgn 90°	met Barney 90°	met Xmen 90°	air plane ride 90°					
5 - 6									
6 - 7									
7 - 8									
8 - 9									
9 - 10									
10 - 11									

SOURCES: Mother, Father, Aunt Jane, and Uncle Joe

NAME *Jane Doe* **DATE** *9/9/99*

POLYGON TIMELINE SAMPLE



KEY
Events/Degree

A.	**Teeth 60°**	**M.**	**Skiing 130°**
B.	**First word 60°**	**N.**	**See Grandma 175°**
C.	**First step 60°**	**O.**	**First book 165°**
D.	**Train ride 65°**	**P.**	**Kindergarten 90°**
E.	**TV ad star 110°**	**Q.**	**Met Barney 90°**
F.	**First party 50°**	**R.**	**Met X-men 90°**
G.	**Movie star 135°**	**S.**	**Airplane ride 90°**
H.	**Preschool 65°**		
I.	**New sister 90°**		
J.	**Potty 25°**		
K.	**Ballet 15°**		
L.	**Beach 55°**		

Teacher Resource #3
Answer Keys for Handouts #4a, 4b, 5, 7a, and 7b

Handout #4a

1. Y = 75°
   O = 30°
   U = 75°

2. A = 50°
   R = 90°
   E = 40°

3. N = 70°
   O = 25°
   W = 85°

4. H = 65°
   O = 90°
   T = 25°

Handout #4b

1. E = 60°
   D = 60°
   F = 60°

2. G = 45°
   H = 45°
   J = 90°

3. 50°

4. 115°

Handout # 5

1. 90° (every angle)

2. 90° (every angle)

3. A = 65°
   B = 110°
   C = 50°
   D = 135°

4. A = 105°
   B = 75°
   C = 75°
   D = 105°

Handout # 7a

A. 540°
E. 540°

B. 360°
F. 720°

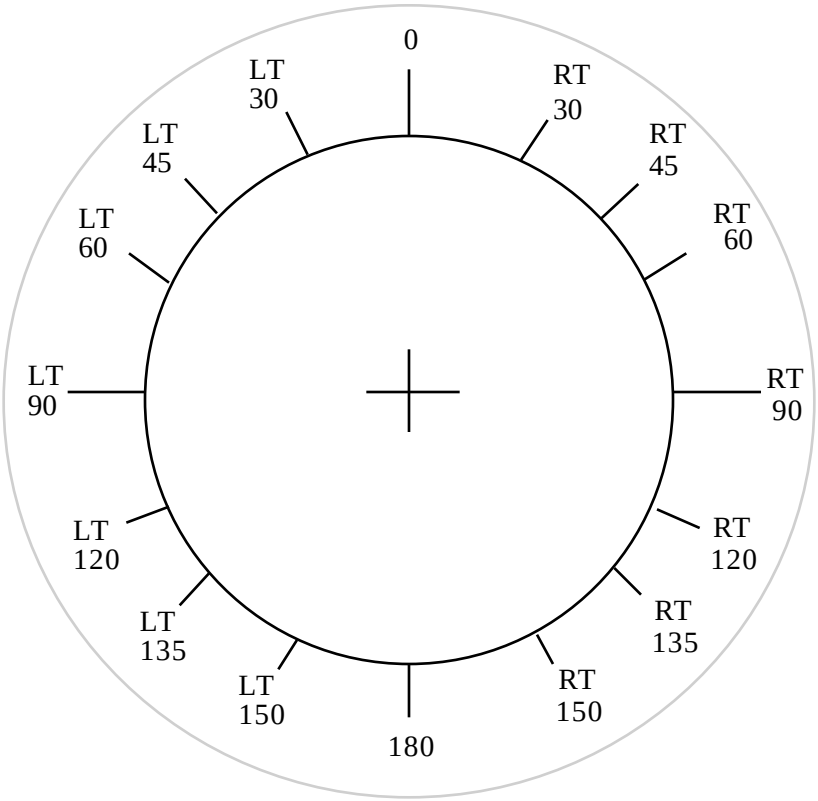
C. 360°

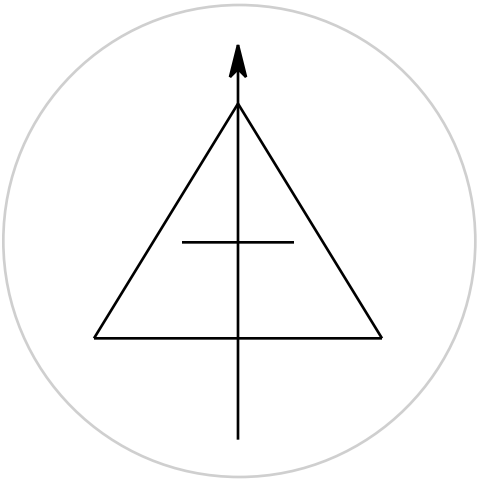
D. 540°

Handout # 7b

How many sides?	What is the Sum of the Angles?
3	180°
4	360°
5	540°
6	720°
7	900°
8	1080°
N	180 (N-2)

STUDENT TRIANGLE DEGREE WHEEL





DIRECTIONS:

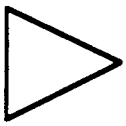
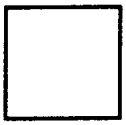
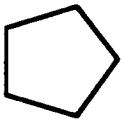
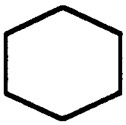
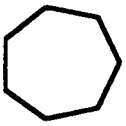
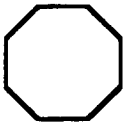
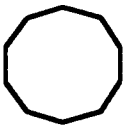
1. Make an overhead transparency of the Student Triangle Degree Wheel for each cooperative group.
2. Cut out the triangle on the dotted line.
3. Cut out the compass on the dotted line.
4. Put the turtle on the compass.
5. Line up the +'s. Fasten the triangle on the compass with a brad.

Adapted from "Logo Geometry - Grade Three Curriculum Guide", Howard County Public School System, 1992.

Exploring Interior and Exterior Turtle Angles

Name _____ **Date** _____

Experiment with the **REPEAT** command to construct each of the regular polygons below. Examine the shape to determine how many times the turtle repeats the pattern. Use the computer and logo software to help determine number of the degrees in each turn. The first command for each program should be **fd 80 bk 80** to draw a line that will help you measure angles.

SHAPE	COMMAND
	**REPEAT** ____ **[FD 40 RT** ____ **]** **Name of shape** ____TRIANGLE____
	**REPEAT** ____ **[FD 40 RT** ____ **]** **Name of shape** ____SQUARE____
	**REPEAT** ____ **[FD 40 RT** ____ **]** **Name of shape** ____PENTAGON____
	**REPEAT** ____ **[FD 40 RT** ____ **]** **Name of shape** ____HEXAGON____
	**REPEAT** ____ **[FD 40 RT** ____ **]** **Name of shape** ____HEPTAGON____
	**REPEAT** ____ **[FD 40 RT** ____ **]** **Name of shape** ____OCTAGON____
	**REPEAT** ____ **[FD 40 RT** ____ **]** **Name of shape** ____NONAGON____
	**REPEAT** ____ **[FD 40 RT** ____ **]** **Name of shape** ____DECAGON____

Adapted from Logo Geometry - Grade Three Curriculum Guide, Howard County Public School System, 1992.

Exploring Interior and Exterior Turtle Angles
Answer Key

2.

Shape	Number of Sides	Total Angle Sum
Triangle	3	180
Square	4	360
Pentagon	5	540
Hexagon	6	720
Octagon	8	1080

3. For each additional side, add 180

4. No. Answers will vary